DOCUMENT RESUME

ED 448 754 IR 020 517

AUTHOR Hartog, Rob J. M.; de Gooijer, C. D.; van der Schaaf, H.; Sessink, O.; Vonder, O. W.

TITLE Comparing Web Based Course Development with and without a Learning Environment.

PUB DATE 2000-11-00

NOTE 8p.; In: WebNet 2000 World Conference on the WWW and Internet Proceedings (San Antonio, TX, October 30-November 4th, 2000); see IR 020 507.

PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Authoring Aids (Programming); Computer Uses in Education; Distance Education; Foreign Countries; Higher Education; Instructional Design; *Instructional Development; *World Wide Web

IDENTIFIERS ARCS Model; *Course Development; Learning Environments; Netherlands; *Web Based Instruction; Web Sites

ABSTRACT

Over the last five years, several online courses covering different subjects have been developed and delivered in different settings at Wageningen UR (Wageningen University and Research Centre, Wageningen, The Netherlands). The total course content developed and delivered with a learning environment is equivalent with about 700 hours of study, and the total course content developed and delivered without a learning environment is equivalent with about 400 hours of study. This paper discusses the theoretical benefits of learning environments in general, the use of Keller's ARCS (Attention Relevance Confidence Satisfaction) model for instructional design, actual experience with a specific Learning environment based on MS SQL Server and Cold Fusion, and the reasons why it was decided not to develop every course in a learning environment. The paper also describes and evaluates the current development approach, which is based on a set of tools for World Wide Web site management and tools for authoring of content. (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 448 754

Comparing Web Based Course Development With and Without a Learning Environment

Rob J.M. Hartog
Wageningen UR
Dreijenplein 2 6703 HB Wageningen The Netherlands
Rob.Hartog@users.info.wau.nl

G.H. Marks

C.D. de Gooijer
Rikilt
Bornsesteeg 45 6700 AE Wageningen The Netherlands
C.D.deGooijer@RIKILT.DLO.NL

H. van der Schaaf, O.Sessink
Wageningen UR
Bomenweg 2 6703HD Wageningen The Netherlands
Hylke.van.der.Schaaf@Algemeen.PK.WAU, OlivierSessink@Algemeen.PK.WAU

O.W.Vonder
Wageningen UR
Droevendaalsesteeg 3 6708 PB Wageningen The Netherlands
OscarVonder@staff.GIRS.wau.nl

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Abstract
Over the last five years several online courses covering different subjects have been developed and delivered in different settings at Wageningen UR. The total course content developed and delivered with a learning environment is equivalent with about 700 hours of study and the total course content developed and delivered without a learning environment is equivalent with about 400 hours of study.
The paper discusses the theoretical benefits of learning environments in general, actual experience with a specific learning environment and the reasons why it was decided not to develop every course in a learning environment. Furthermore the paper describes and evaluates the current development approach which is based on a set of tools for web site management and tools for authoring of content.

1. Introduction

Over the last five years several online courses covering subjects in computer science, construction, geophysics, geographical information systems, recombinant DNA technology, food process engineering and food fermentation have been developed and delivered in very different settings at Wageningen UR. For some of the courses a web based learning environment has been used, for other courses a web site management system complemented with a set of techniques and tools has been chosen. The total course content developed and delivered with a learning environment is equivalent with about 700 hours of study and the total course content developed and delivered without a learning environment is equivalent with about 400 hours of study by the average student.
This paper describes the main functions of learning environments and discusses the theoretical benefits of using such a learning environment. Next the paper describes an in house developed learning environment based on MS SQL Server and Cold Fusion and the experience with this specific learning environment so far.

IR020517

BEST COPY AVAILABLE

Based partially on this experience in web based course development about two years ago two more projects were formulated to develop and produce web based courses in food and biotechnology and geographical information systems. First the objectives of these projects will be described as well as the intended scenario followed by an explanation of the reasons to make a transition to a rather different scenario without a learning environment.
The paper describes and evaluates this second scenario based on the use of MS Frontpage 2000 and a complementary set of tools and techniques such as Java script, ASP, JOUST and several other tools.

Learning environments.

Over the last few years many learning environments became available such as Lotus Learning Space, Pathware, Librarian, Ingenium, OLA , NGL, Blackboard, Gentle, webCT, Referentia Learning Systems Mercator, Swift, Vcampus to mention only a few. A good overview of relevant functional requirements can be found in (WSU 2000).
A look at the functional specifications of commercially offered learning environments shows much convergence: at a high level most of the designers agree on the following functional specifications:

- User management and authorization, users having roles such as: the role of student, instructor, author, examiner, reviewer, and etceteras.
- Management of reusable content
- Course and curriculum configuration (ideally including dynamical configuration)
- Enabling computer supported collaborative learning and communication between users
- Tracking and tracing and adjusting (manually or automatically) of user profiles and authorization

This set of main functions implies that each user is offered an environment in which (s)he can optimally perform his/her own role. Every group of users will have their own set of sub functions. For instance students and authors will have search, navigation and orientation functionality. Authors will have meta data entry and structural hyperlink management functions. Administrators will have user and group management functions.

Supporting the creation of digital learning material is generally not considered a function of a learning environment but a function of an authoring tool. Ideally lecturers create reusable content objects (RCO's), store these reusable content objects in learning environments and use the learning environment to create learning routes for students where these reusable content objects are stepping stones along the route. An RCO can be any object, ranging from static text, picture, animation, sound and video to interactive text , simulation and animation.

The paradigm which is implicit in the main functions that are supported by commercially available learning environments, does not include support for instructional design. A learning environment supports many different instructional models i.e. enables course developers to provide students with different scenarios with learning activities.

Developing and delivering courses in computer science and related subjects.

In 1995 a start was made with the development of low budget online courses in computer science. The main objectives where to make computer science education more attractive to the students and to reduce the workload for the instructors in the computer lab.

Traditional computer science courses consisted of a series of lectures separate computer lab sessions. Students making assignments in the computer lab are confronted with an incredible amount of detail. This results in students getting stuck already during an initial stage of the assignment. To resolve this problem the necessary details were told to the students in advance during the lecture and a high staff/student ratio was maintained for computer lab sessions.

The solution was to present all the necessary detailed knowledge in 5 minute audio visual movies (Lotus Screencam ® or Hypercam ®) and to offer those movies "at the right moment".
For students this meant: no boring lectures with a plethora of details and during the computer lab session no waiting for the instructor to come along to relieve one from a stuck state.
Students view a short presentation (5 minutes), work on an assignment (45 minutes) and view - if necessary - movies with hints or answers.

The ARCS model (Keller 1987) was chosen as the main guideline in instructional design. The ARCS model is used as follows: every movie and every triplet was created and placed in an order with the ARCS model in mind. The author would answer for each movie and each triplet the questions: will this movie in this stage of the course really catch the Attention of the student, be perceived as Relevant by the student, support the Confidence of the student, and generate Satisfaction.

Initially an extension to the MS Windows Help system was made in order to manage and deliver the movies. To allow easier management of the ever growing content a web based application built with MS SQL Server and Cold Fusion was designed and implemented.

Because the ARCS model was so easy to apply and helpful in designing motivating course material it was decided to baptize the web based application the "Keller system". This does not mean in any way that the Keller system itself forces the author to use the ARCS model.

The Keller system should be used as follows. A course is delivered once a year in the computer lab. During these sessions it usually turns out that certain RCO's are misleading or confusing or should be offered in a different order. This leads to immediate improvements in the course.
Apart from these supervised computer lab sessions students can start the course any time and any place and take an exam also at their own convenience. They can communicate with the lecturer by phone, e-mail or chat or knock on his/her door. Students are encouraged but not obliged to work in small groups.
Today several hundreds of students in three departments have followed courses in the Keller system. Most students are positive about the courses they have attended. Students like the type of assignments, the fact that initially they don't have to read much and the fact that they can do the courses outside scheduled time slots. Smart students are generally less satisfied with movies: they feel that watching movies slows them down because they cannot scan a movie as quickly as they can scan a written text for just that one thing they need.
Lecturers and instructors working with the Keller system are satisfied the underlying philosophy and feel that their efforts are in balance with the results.
The fact that the Keller system uses http to deliver course material, netbios file sharing to upload course material by lecturers and Banyan Vines to upload students' homework requires maintenance of three sets of user accounts. The Banyan Vines dependency, requiring a network account, limits the group of students that can attend the online courses resulting in frequent requests for a course CD ROM. This is an important detail because several commercially available learning environments essentially know this same problem although it is often difficult to detect this in their functional specifications.

Developing and delivering courses in Food and Biotechnology

Main objectives

Food and Biotechnology as well as Geographical Information Systems are, much more than computer science, core competence areas of Wageningen UR. In particular the Educational Institute of Technology and Nutrition (EITN), which is the school responsible for education in Food and Biotechnology has made its objectives very explicit.
The reasons for the EITN to invest in development of web based course material are based on the strong belief that - for a modern university - it is important to be present and visible on the internet, not only as a research institution but also as an educational institution providing high quality education in those areas which form the core competence of research this specific university.

The EITN regards web technology as the enabling technology to realize the benefits of economics of scale in higher education. By experience it is well accepted that the overall quality of lecture notes written for only a limited cohort of students cannot compete with a good textbook (Stryer 1995, Alberts 1995) intended for a large audience. The reason is that it seldom makes sense to invest heavily in course material intended for a very small audience. This argument is just as valid for digital course material as it is for textbooks. The current internet developments will enable universities to reach a larger audience and thus to raise the quality of course materials. Furthermore the EITN promotes life long learning in an international community. Thus the main objectives are: to develop high quality digital course material, to enlarge the audience, to offer a wide range of students in different settings different learning scenario's and to improve the web presence and visibility of the university.

Intended development Scenario
When the development of web based courses in food- and biotechnology and geographical information systems was started, the following development scenario was planned:

- Define learning activities
- Select a commercially available learning environment
- Define a course material development methodology
- Define together with authors a subproject for each subject
- Give authors a course in web based course development
- Give authors sufficiently didactical and technical support
- Start developing

This scenario is somewhat inspired by the traditional textbook publishers approach and also by what has been called the learning environment paradigm. It is clearly a scenario intended to create synergy between the several subprojects for instance by using one technological basis for all subprojects.

Later sections explain the reasons why this scenario was gradually replaced by a rather different scenario.

Different Learning activities lead to composite RCO's.
Typical learning activities in computer science, systems modeling, agricultural engineering etc. were 45 minute assignments for a computer program, (testing) a mathematical model, do some calculations etc. The Food and Biotechnology project and the Geographical Information Systems project however required learning activities which were quite different because of the course content and learning goals.

Two students were asked to scan the web for course material in food and biotechnology and to compose a top ten of course materials they liked from their own viewpoint. From their results it was concluded that for subjects in food and biotechnology typical learning activities should often be more related to real life situations. Most of the courses are now case based, wherein the student is placed in a role of junior consultant or lab supervisor. The student, for example, has to provide advice on optimizing a production plant or to diagnose errors in an experimental set up.

This type of learning activities introduces the problem of composite RCO's. A composite RCO is an RCO which it self consists of a structure of linked RCO's. The didactical approach based on cases needs composite RCO's that use their own navigation based on user interaction. Because of the interaction this navigation is hard to implement within a learning environment. An extreme case is the situation where one has only a few RCO's in a learning environment that have their own navigational structure. Clearly this would undermine the reasons to use a learning environment at all. In fact this occurs already in the process-engineering site.

Selecting a learning environment.

The experience with the Keller system had supported the belief in the benefits of a learning environment and also provided a good idea of the desired functional specifications. It was soon clear that several learning

environments had more potential than the in-house developed Keller system. A committee was formed to select a standard learning environment. However during the short selection process some learning environments where retracted from the market, some environments were integrated with others and several new candidates appeared. The turbulence in the market was one of the most important reasons to postpone the definitive choice for a learning environment.

The general opinion still was that the benefits of a learning environment will eventually outweigh the limitations of a learning environment. But two things were cause for concern: firstly not one vendor of a learning environment could give a pointer to course material which appealed to the students, and secondly not one of the examples that did appeal to the students was build with a learning environment.

Yet another reason to postpone the final choice was the overlap in functionality between a learning environment on the one hand and functionality which was being realized in a digital library project within the university (including the digital learning material) and a new student administration project.

Finally in practice the most important factor in many decisions during initial development of online courses is the satisfaction that authors derive from their development efforts and the expectation that faculty members have from future benefits. One of the problems is that the benefits of a learning environment only become visible when a certain critical mass has been attained. It was foreseen that working with a learning environment initially might involve too many tedious tasks and that faculty members might drop out.

Current Approach

In the meantime course material in food and biotechnology and geographic information systems was under development. This course material is developed using Front page 2000 and JOUST for navigation and server and client side Java script and Java for interaction.
At the time of writing only about 20 to 30 students have provided feedback on the course material. This feedback is very favorable on the didactical approach but very critical on many practical details.
The development approach is very much an evolutionary approach inspired by ideas like rapid application development or DSDM (Stapleton 1997) in information systems development.
Sometimes lecturers come up with ideas for certain functionality and the technical support team implements this functionality. Some lecturers try to implement ideas for functionality in a prototype themselves in order "to be able to go on" and in order to be able to clarify their request to the technical support team. Some authors just "throw their ideas and content over the wall" and let the support team do most of the non content related work. In this teamwork with the faculty members the technical support team acts as a powerfull "bottom up" stimulator for faculty members to invest their valuable time in development of digital course material. (cf. Collis & Wende 1999 section 4.4.2)

Lecturers use a Frontpage web as learning environment and at the same time use Frontpage as an authoring tool for some of their RCO's in particular. Creating navigational structures at learning environment level requires the same skills as creating navigational structures at the RCO level.
Because Frontpage is also elsewhere in use for normal website management there is a certain critical mass of Frontpage users. The current set of tools gives more room for experimenting than working with a learning environment.

Still working with Frontpage instead of a learning environment is regarded as a temporary solution because there are some disadvantages as well. First of all the borderline between RCO and learning environment has become quite fuzzy. This will create some problems when the transition to a learning environment comes later on. Secondly a package like Frontpage invites faculty members to dive into technological details and time invested in technology is time lost for didactical creativity. Furthermore Frontpage does not keep faculty members on one common track like a learning environment would do. On the one hand Frontpage gives more freedom than a learning environment on the other hand more advanced users switch to more flexible tools and

the support team feels inhibited by the inflexibility of Frontpage when implementing the "throw their ideas and content over the wall" concept. Supporting authors who work with Frontpage and extending its functionality also incurs certain costs. Finally the functionality of the current Frontpage based web including home built extensions is still much less than the functionality of a learning environment.
To summarize: working with Frontpage provides more flexibility than working with a learning environment but at certain costs and these costs are expected to increase rapidly with increasing volume of course content.

Conclusions

Experience with development of digital course material along two different scenario's has been described. Based on this experience the ideal setting for development of online course materials is defined as follows:

- The university supports one learning environment for every learning scenario and every lecturer
- Lecturers create modular digital learning materials (reusable content objects) with authoring tools of their choice.
- Lecturers do not invest their valuable time in matters of layout, HTML, XML, Javascript etceteras. Lecturers are supported by a small support team to that end.

This setting is not fundamentally different from the production setting that a publisher provides for textbooks.

Choosing a standard learning environment is partly a matter of careful timing. The choice for a standard learning environment was postponed for the following reasons:

1. The market for learning environments is currently too turbulent: environments are being integrated into other environments and environments are retracted from the market. The risk that a freshly chosen standard will soon end to exist is too large.
2. Within the university administration new systems for student administration are being developed, and within the university library new ideas for management of digital learning material are coming up. Having three systems with considerable overlap in functionality is at least sub optimal.
3. Composite RCO's are difficult to deal with in the currently available learning environments.
4. Learning to work with a learning environment requires usually considerable efforts from lecturers, while the benefits will only become visible much later.
5. Until now none of the vendors of a learning environment has been able to demonstrate a convincing lighthouse application that can function as a paradigm example for courses to be offered with this learning environment.

The current approach of developing digital learning material with MS Frontpage 2000 and extending the functionality when necessary is felt to be satisfactory. The advantage of the current approach is that it is very flexible in particular with respect to composite RCO's. The disadvantage of this flexibility is the costs for development and maintenance it incurs.

References

Alberts B. et. Al (1995). *Molecular Biology of the cell*. Garland Publ

Collis B & Wende M (eds) (1999). The use of information and communication technology in higher education.: An International Orientation on Trends and Issues, *CHEPS report*, Enschede

Keller J.M. (1987). Development and use of the ARCS Model of Motivational Design *Journal of instructional development*, 10 (3), 2 - 11

Stapleton J (1997). *Dynamic Systems Development Method : The Method in Practice* Addison-Wesley Pub Co;

Stryer L (1995). *Biochemistry* New york W H Freeman and Co;

Wichita State University (WSU 2000). *Comparison of Features, Tools, Specifications, Support, & Pricing* Updated 1/26/00 http://www.mrc.twsu.edu/mrc/im2/websystems.htm